

DOCUMENT RESUME

ED 076 640

TM 002 645

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TITLE Clinical Evaluation and the Classroom Teacher.
PUB DATE 73
NOTE 8p.; Paper presented at American Educational Research Association Meeting (New Orleans, Louisiana, February 25-March 1, 1973)

EDRS PRICE MF-\$0.65 HC-\$3.29
DESCRIPTORS *Clinical Diagnosis; Elementary Grades; *Elementary School Mathematics; *Evaluation Techniques; *Measurement Techniques; Speeches; Student Evaluation; *Teacher Improvement; Video Tape Recordings

ABSTRACT

Changes that have occurred in the area of measurement and evaluation for the classroom teacher, as related to the specific area of elementary school mathematics, are discussed. From observation, it is suggested that developments in measurement and evaluation in the past have generally been somewhat detached from the classroom situation; have continued to strive for objectivity and standardization; have been more concerned with group comparisons than with individual progress; have tended to be concerned with segregated mathematical behaviors and not with the integrated whole of mathematical behavior; and have become more complex in mathematical behavior sampled, but remain dominated by the paper and pencil mode in presentation. Some of the potential of clinical evaluation procedures for the classroom teacher in making judgments on student learning in elementary school mathematics is examined. The videotaped clinical interview appears to have considerable potential as a tool in the measurement and evaluation arsenal for the classroom teacher. This potential appears to be in the functions of the measurement and evaluation process dealing with individual diagnosis and individual inventories of knowledge. The clinical interview coupled with videotaping procedures may also be extremely useful in teacher education. (DB)

CLINICAL EVALUATION AND THE CLASSROOM TEACHER

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Efficiency and effectiveness in any line of human endeavor depends greatly on the ability to evaluate results that have been secured. For the classroom teacher responsible for the education of a group of students in a classroom, evaluation procedures are a critical component of the instructional procedure. Classroom teachers have experienced dramatic changes in other components of instruction in the past years, e.g., the content of various subject-matter areas have changed through the developmental work of the various curriculum projects; technology has had an impact on the manner in which knowledge can be transmitted; new ideas on organizing the classroom for instruction have emerged. What changes have occurred in the area of measurement and evaluation for the classroom teacher? This paper will be concerned with this question as it relates to the specific area of elementary school mathematics.

Brownell (1941) stated that evaluation procedures in mathematics should aid the classroom teacher: (a) diagnose class and individual difficulties; (b) inventory knowledge and abilities of the class and individuals in the class; (c) determine the extent of learning by individuals, and the class, taking place over a period of time; (d) obtain measures of mathematical learning for comparative purposes. An evaluation program for the classroom teacher should then be judged in the light of its effectiveness in accomplishing those functions. What progress has been made in the development of more sensitive

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measurement and evaluation procedures for the classroom teacher in the area of elementary school mathematics? Following are some personal observations on trends that characterize the dynamic activity in this area over the past few decades.

1. Measurement and evaluation development procedures have continually become more detached from the classroom teacher. Much of the resources, human and financial, involved in measurement and evaluation activities over the past years were primarily concerned with the comparative function at the national and international level. Brownell (1941) voiced concern for this trend over a quarter-century ago.
2. Measurement and evaluation development procedures have continually become more objective. In the quest for a science of education measurement and evaluation procedures have tended to become more and more standardized in order to achieve objectivity. Biggs and MacLean (1969) voiced concern that this may cause teachers to lose confidence in their own subjective judgments and also cause a rigidification of curriculum in elementary school mathematics.
3. A corollary of the previous observations is that measurement and evaluation procedures generally ^{have} been concerned with group administration and normative interpretation. There have been some recent developments, however, in mastery testing and criterion-referenced tests. (Bloom, et al, 1971)
4. Measurement and evaluation procedures in elementary school mathematics have tended to develop in segregated parts rather than as an integrated whole. The tendency has been to develop separate means for sampling various components of mathematical behavior. Separate

instruments have been developed to measure attitude, skills, concepts, problem solving, etc.. The classroom teacher synthesizes information from the parts in evaluating the totality of mathematical behavior. Means of observing synthesized units of mathematical behavior of students might prove to be a useful means of increasing the classroom teachers evaluation of the "whole child" in mathematics development.

5. Although the complexity of mathematical behavior to be measured has increased, the manner in which the measurements are carried out have not changed greatly. Human and financial resources have been used in generating tasks that measure increasingly complex mathematical behaviors. These tasks are then printed on paper, students read the item and respond by writing on an answer sheet. Classroom teachers are encouraged to present mathematical tasks in many forms, yet the manner in which measurements are carried out are often not a great deal different from the manner Joseph Rice (1902) used in measuring mathematical behavior three-quarters of a century ago.
6. A corollary of the previous observation is that measurement of the complex mathematical behaviors are carried out by using more and more indirect means of measurement. When paper and pencil means are used to sample complex mathematical behavior the classroom teacher must make many inferences from these indirect measurements. It may be beneficial of observing complex mathematical behavior could be developed.

A summary of the previous observations would suggest that developments in measurement and evaluation in the past have generally been somewhat detached from the classroom situation; have continued to strive

for objectivity and standardization; have been more concerned with group comparisons than with individual progress; have tended to be concerned with segregated mathematical behaviors and not with the integrated whole of mathematical behavior; have become more complex in mathematical behavior sampled but remain dominated by the paper and pencil mode in presentation.

If these observations are accurate, there would seem to be a need by classroom teachers for some refocusing of development in the measurement and evaluation of learning in elementary school mathematics. There would appear to be a general "press" on teachers to be more sensitive to the learning of each individual student in the group; to be more humanely subjective in judgments rather than coldly objective; to be flexible and creative in approach rather than rigid and traditional. Can the measurement and evaluation component of the instructional process develop and react constructively to this "press"? The challenge would seem to be in being able to cling to the progress that has been made in evaluation in the past^{while} expanding the development of procedures that will complement present measurement and evaluation components used by classroom teachers in their instruction.

The remainder of the paper will examine some of the potential of clinical evaluation procedures for the classroom teacher in making judgments on student learning in elementary school mathematics.

Over the past few years some of my students and I have been exploring the value of the clinical interview, coupled with the video-taping process, as a means of diagnosing individual learning difficulties in elementary school mathematics. Various researchers (Brownell, 1967; Gray, 1967; Weaver, 1955) have described the value of the interview as an evaluation technique. Use in use of video-taping

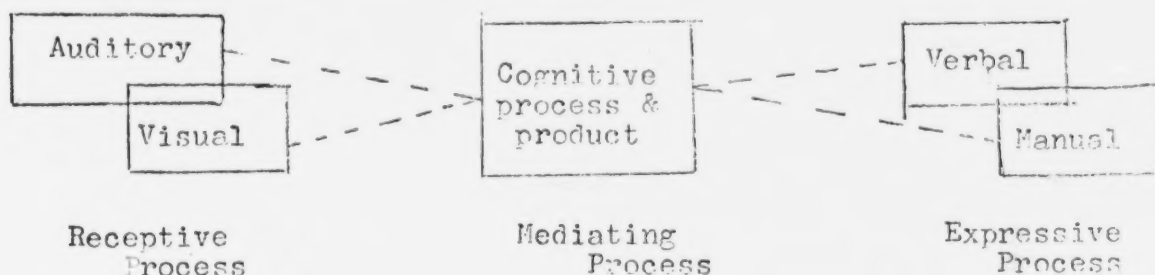
procedures has made the recording of mathematical behavior sampled in the interview simpler.

A clinical procedure used in evaluation has certain characteristics essential to the process. It involves direct observation of an individual student; it tends to be carried out in a manner that is analytical and ego-detached on the part of the interviewer. In the rather gross inventory we have used with third-graders, the clinician uses a prescribed protocol as an interview guide but is encouraged to probe student behavior if clarification is needed. The sample of mathematical behavior elicited by the inventory protocols is generally able to be recorded on a half-hour tape. The clinician then can play the tape for the teacher of the student interviewed, stop and replay the tape to point out especially insightful behaviors, and generally discuss the one-half hour of essential mathematical behavior. The procedure is similar to that used by so many football coaches in evaluating the performance of their individual players.

Present protocols used with third graders include questions which elicit behavior related to: (a) skill in reading, writing, and comparing whole numbers and understanding of the Hindu-Arabic numeration system; (b) proficiency in adding and subtracting whole numbers, maturity level of the processing, and understanding of the operations and their properties; (c) sensitivity to social applications which includes conservation and estimation of length, weight, time and some tasks involving money; (d) clarity and stability of concepts of simple geometric shapes.

Some of the protocol tasks are presented orally by the clinician while others are presented in written form. Some tasks call for oral responses by the student, some call for written responses, while

still others call for manipulation of objects. In viewing the half-hour of behavior on tape, an adaptation of Kirk's model (1971) serves as a useful guide. Observations can be made on aural and reading



receptive processes; oral, writing and manipulative expressive processes; and of course the "guts" of the behavior sample which involves the cognitive stuff of mathematics. It is often possible to observe affective behaviors on the tape. also...unsolicited comments on dislike for arithmetic, overt manifestations of stress or anxiety in a quantitative situation, etc..

The videotaped clinical interview would seem to have quite a bit of potential as a tool in the measurement and evaluation arsenal for the classroom teacher. The potential would seem to be in the functions of the measurement and evaluation process dealing with individual diagnosis and individual inventories of knowledge. Some of the characteristics of the process that would seem to make it a good complement to the traditional measurement and evaluation procedures include:

1. The procedure seems less detached for the classroom teacher. She can actually observe the student's thinking regarding the various protocol tasks.

2. The procedure often presents the very individualistic nature of learning in mathematics. The probes of the clinician and the

visual and auditory record of the tape will often point out the very idiosyncratic nature of the thinking process.

3. The half-hour record of mathematical behavior tends to be a more integrated sample of mathematical behavior than teachers can normally get from traditional measurement procedures. It tends to be a more "wholistic" behavioral reaction to essential mathematical tasks.
4. The procedure allows for more diversity in the input and output modes. Although some tasks are presented on paper and require written output, this is not true of all the tasks.

Others on the panel have discussed the potential of clinical procedures in generating viable hypotheses for research in elementary school mathematics. There is another benefit that I believe can be derived from the procedure...it is in the area of teacher education. The "need" that the procedure may make a contribution to satisfying was articulated by Mayer (1961) and more recently cited by Lovell (1972)

What future teachers need, and cannot now find, is the course which attempts to explore the profound aspects of the deceptively simple material they are going to teach, which analyzes case by case the types of difficulty that children find in approaching such material...

The clinical interview coupled with modern videotaping procedures may be a very useful procedure in the area of teacher education. This, along with its potential for classroom teachers in their measurement and evaluation arsenal and for researchers in the area, make clinical procedures in elementary school mathematics pregnant with possibilities for development in the future.

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